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REMARKS UPON THE NATURAL HISTORY OF *GERRHONOTUS PANAMINTINUS* STEBBINS

By
Benjamin Harrison Banta

Research Biologist,
California Academy of Sciences

Field work in the Saline Valley hydrographic basin, Inyo County, California, during 1959 and 1960, resulted in the collection of a large number of reptiles, among which were six specimens of the rare Panamint alligator lizard, *Gerrhonotus panamintinus* Stebbins (1958). These records extend the known geographic range altitudinally and latitudinally and provide additions to the knowledge of seasonal activity, habitat distribution, reproduction, parasitism, color variation, and external morphological variation.

Materials and Methods

The specimens reported upon herein were obtained in buried-can "pitfall" traps (Banta, 1957) and are now deposited in the herpetological collections of the California Academy of Sciences. The traps were set out according to the automobile speedometer and with no regard to particular environmental situations. It is believed that this method afforded an opportunity to obtain a random sampling of the entire small-sized terrestrial fauna, including arthropods, reptiles, and mammals.

Collecting Stations

Specimens of *Gerrhonotus panamintinus* were taken at two general areas in the Saline Valley hydrographic basin: 1) Nelson Mountains, Grapevine Canyon; and 2) on the east slope of the Inyo Mountains, on the north side of Daisy Canyon.

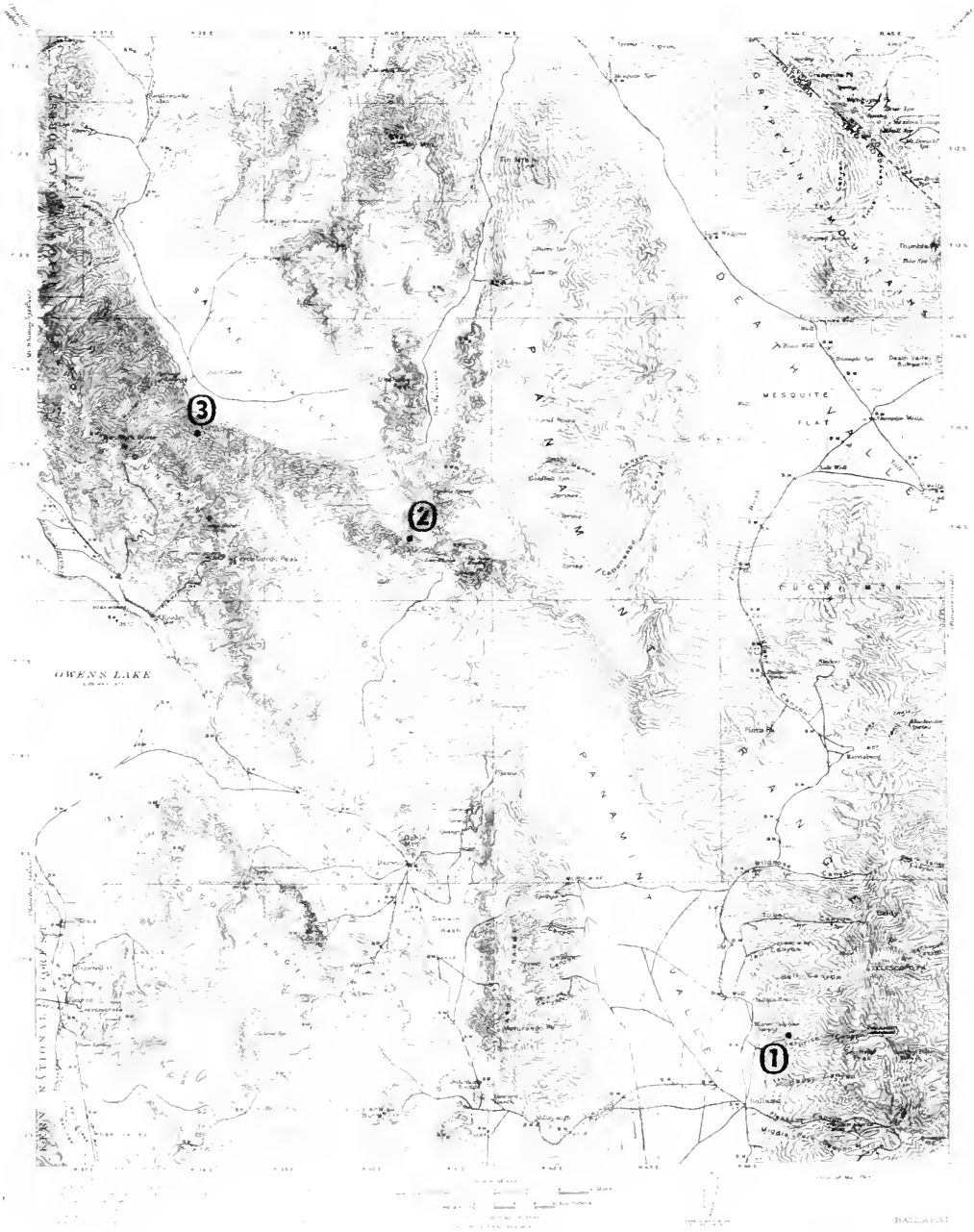


Figure 1. Distribution of *Gerrhonotus panamintinus* Stebbins. (1) Surprise Canyon. Panamint Mountains (type locality); (2) Nelson Mountains, Grapevine Canyon; (3) Inyo Mountains, Daisy Canyon. Photograph of U. S. Geological Survey Ballarat Quadrangle by Maurice Giles.

Figure 2. Nelson Mountains, Grapevine Canyon. Elevation 5100 feet. Station 11 (left) and station 12 (right). March 1959. These two stations were adjacent to one another, and were the only ones that were not at least 0.2 of a mile apart in Grapevine Canyon. An adult female of *Gerrhonotus panamintinus* was trapped in a buried can and collected on September 16, 1960 at Station 12. It is interesting to note that in this particular instance where there was a mesic environment on one side of the road and a xeric situation on the other, the specimen of *G. panamintinus* was obtained in the latter, a phenomenon which was not anticipated.

I. Nelson Mountains, Grapevine Canyon

Elevation 4000 to 6000 feet. Twenty-five "pitfall" trapping stations, consisting of four containers each, were set out, usually at 0.2 mile intervals along the dirt road descending into Saline Valley. Of the 25 stations, specimens of *G. panamintinus* were collected at the following four:

Station 12. *(Figure 2.)* Elevation 5100 feet. This site is situated across the dirt road from Station 11 which somewhat resembles the type locality of the species at Surprise Canyon, Panamint Mountains, being characterized by a tree and shrub flora dominated by willows *(Salix laevigata* and *S. lasiolepis)*, virginsbower *(Clematis lugusticifolia)*, and wild grape *(Vitis Girdiana)*. The immediate environment of the station around which four "pitfall" traps were set was covered with low desert shrubs. Reptiles obtained in (or near *) the traps at this station included *Sceloporus occidentalis longipes* (7)[1/]; *Uta stansburiana stansburiana* (7); *Cnemidophorus tigris tigris*

1/ Numbers in parentheses refer to specimens in the collections of the California Academy of Sciences.

(4); *Gerrhonotus panamintinus* (1); **Crotalus mitchelli stephensi* (1); **Salvadora hexalepis mojavensis* (1).

Station 13. *(Figure 3.)* Elevation 5000 feet. The environment at this site contained a flora indicating more xeric conditions than at Station 12. Reptiles collected at this station included *Sceloporus occidentalis longipes* (9); *Uta stansburiana stansburiana* (14); *Cnemidophorus tigris tigris* (17); *Eumeces gilberti rubricaudatus* (3); *Gerrhonotus panamintinus* (1).

Station 14. *(Figure 4.)* Elevation 5000 feet. Xeric vegetation. Reptiles collected were *Sceloporus occidentalis longipes* (2); *Uta stansburiana stansburiana* (7); *Cnemidophorus tigris tigris* (1); *Eumeces gilberti rubricaudatus* (5); *Gerrhonotus panamintinus* (1).

Station 16. *(Figure 5.)* Elevation 4850 feet. The environment at this station was similar to that described by Stebbins (1958, pp. 11-12) for the type locality of *G. panamintinus* in Surprise Canyon. *Salix laevigata, S. lasiolepis, Clematis lugusticifolis,* and *Vitis Girdiana* were the dominant tree and shrub cover, affording a relatively lush situation in comparison to the surrounding hillsides. Reptiles collected included *Sceloporus occidentalis longipes*

Figure 3. Nelson Mountains, Grapevine Canyon. Elevation 5000 feet. Station 13. March 1959. Four buried can "pitfall" traps were located on a line on the left side at the base of large basalt boulders. An adult male of *Gerrhonotus panamintinus* was found dead in a buried-can trap on May 7, 1960.

(4); *Cnemidophorus tigris tigris* (2); *Eumeces gilberti rubricaudatus* (13); *Gerrhonotus panamintinus* (2). The usually omnipresent *Uta stansburiana* was conspicuous by its absence.

Other stations in Grapevine Canyon, which vegetationally closely resembled the type locality in Surprise Canyon, but which did not yield specimens of *G. panamintinus*, were Station 9 (elevation 5320 feet), Station 16A (elevation 4860 feet), Station 21 (elevation 4480 feet), and Station 25 (elevation 4030 feet). However, each of these stations did yield a moderate number of specimens of *Sceloporus occidentalis longipes* and *Eumeces gilberti rubricaudatus*.

Figure 4. Nelson Mountains, Grapevine Canyon. Elevation 5000 feet. Station 14. March 1959. "Pitfall" traps were located in the gravelly alluvium at the base of the piled boulders. A young adult male of *Gerrhonotus panamintinus* was obtained here on June 14, 1960. See plate 1 (CAS 89675).

II. Inyo Mountains, Daisy Canyon

A series of "pitfall" trapping stations, consisting of two cans per station, were set out along a little-used path ascending the relatively bare and steep slope of the Inyo Mountains along the north ridge of Daisy Canyon. This area was immediately to the north of the abandoned tramway, which for some years had transported salt in metal buckets from deposits in the center of Saline Valley westward over the steep Inyo Mountains to a railroad siding at

Keeler, Owens Valley. Out of a total of 30 stations, only one produced a specimen of *G. panamintinus*.

Figure 5. Nelson Mountains, Grapevine Canyon. Elevation 4850 feet. Station 16. The environment viewed from the south as it appeared in May 1959. This station closely resembles that of the type locality for *Gerrhonotus panamintinus* in Surprise Canyon, Panamint Mountains. Two specimens were obtained here; an adult female on May 2, 1959, and an adult male on June 10, 1960. See plate 1 (CAS 89676).

Station 125. *(Figure 6.)* Elevation 4000 feet. Granite boulder talus. This site was by far the most arid one sampled which yielded alligator lizards. The flora immediately surrounding the area was composed of the following shrubs; *Atriplex canescens, Arenaris macrodenia, Brickelia atraclyoides, Chrysothamnus teretifolius, Encelia* spp., *Grayia spinosa, Gallium stellatum, Menodora spinescens,* and an undetermined perennial bunch grass. The cacti *Opuntia basilaris* and *Echinocactus acanthodes,* and a creosote bush, *Larrea divaricata,* were growing nearby. No other reptiles were collected at Station 125, although a worm snake, *Leptotyphlops humilis,* was obtained in a can at an adjacent (lower) station (Station 124; elevation 3900 feet). Of the two five quart cans set out in the talus at Station 125, one was pushed aside by a minor rock slide at the time the specimen of *G. panamintinus* was obtained on June 11, 1959.

Figure 6. Inyo Mountains, Daisy Canyon. Elevation 4000 feet. Station 125. This is the most xeric environment at which a specimen of *Gerrhonotus panamintinus* was obtained. A large adult male was collected on June 11, 1959 in a five-quart can set out in the talus. See plate 1.

General Remarks

The discovery and description of the Panamint alligator lizard is without doubt the most remarkable herpetological find within the Great Basin for a considerable number of years. It is indeed interesting that such a distinct form should have remained unknown until recently.

Stebbins (1958, p. 15) commented that *G. panamintinus* "is closely restricted to the vicinity of water. ...The greatest distance from water at which a specimen was found was 30 feet. All sites of capture were well shaded, and there was damp soil at or within a few feet of the place of capture." Only two specimens captured in Grapevine Canyon, at Station 16, were from a well shaded, damp area, and even there, there was no open water. The specimen from Daisy Canyon, Inyo Mountains, was from an extremely arid environment. Equally hydrophilic organisms such as land snails occur under rocks and boulders of talus slopes in otherwise xeric situations. Thus *G. panamintinus* is not exclusively restricted to moist situations, and does move great distances from water into rather arid situations.

Stebbins (1958, p. 10) also stated that "..the Surprise Canyon populations could not be connected with populations that might exist in other canyons." The collection of *G. panamintinus* from arid situations at Station 125

in the Inyo Mountains and the more xeric Grapevine Canyon stations suggests that connections between the populations in many of the canyons is not only possible, but must actually exist.

The seasonal occurrence of *G. panamintinus* based upon all known samples (including the holotype and paratypes) is shown on table 1. May and June are probably the periods of greatest sexual activity. One adult female (CAS 88135), obtained on May 1, 1959, contained twelve developing eggs, three of which were 2.4 mm. in diameter; the remaining nine ranged from 3.4 to 4.4 mm. in diameter. The excessive heat of July and August probably induces thermal aestivation. Two lizards mated in captivity in May 1961 (Banta and Leviton, 1961).

TABLE 1. *Seasonal occurence of* Gerrhonotus panamintinus

Month	Total number of specimens obtained	Males	Females	Juveniles
April	1	1		
May	2	2		
June	6	2	1	3
July	0			
August	0			
September	1		1	

Stebbins (1958, p. 15) remarked that "the behavior of the type specimen in captivity suggests that the lizard is a good climber." Three specimens (plate 1, lower figure) kept alive in a glass terrarium with several twigs angling up against the walls, were often observed either climbing or perched upon the twigs. These same three captive specimens were also observed digging into the same bottom of the terrarium, and occasionally observed lying almost totally covered by sand. Of the three specimens obtained alive in 1960, one was sacrificed for experimental purposes and the other two died from heavy infestation of mites after living captivity for almost a year.

Gerrhonotus panamintinus probably has a wider distribution in the desert mountain ranges adjacent to the Inyo and Panamint mountains than current records indicate (figure 1), and likewise an even greater distribution during the various moist Pluvial periods of the Pleistocene. During the last Pluvial period which ended approximately 11,000 years ago (Broecker, 1957), climatic conditions were probably more favorable for its occurrence at much lower elevations. Since the climate has become more arid, it has survived only in

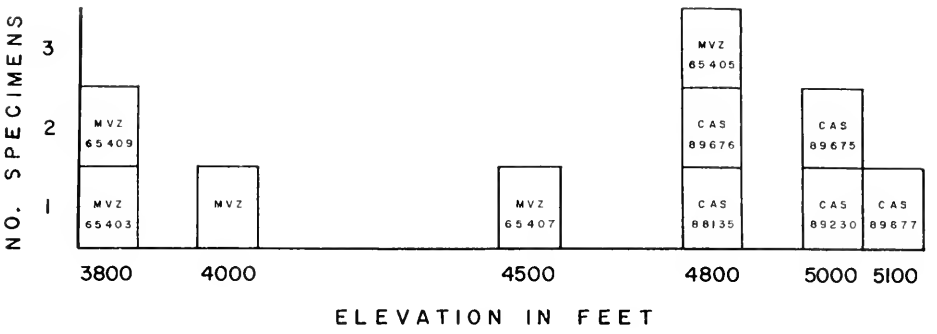


Figure 7. Altitudinal distribution of *Gerrhonotus panamintinus*.

the more favorable environments found in the more mesic canyons and talus slopes of the higher mountain ranges. More exact knowledge of the present range would provide further evidence to understand the probable distribution of the *G. panamintinus* during Pluvial times, and the subsequent migrations and retreats since the close of the last Pluvial period. However, the difficulty in obtaining samples of this species encountered by Stebbins (1958), and the author, cannot be minimized. Since many of the areas in the desert mountain ranges, where it is likely to occur, are relatively inaccessible except by pack-animal or four-wheel-drive vehicle, the determination of distributional limits may not be accomplished for some time to come.

The lizard obtained on the eastern slope of the Inyo Mountains at Station 125 is remarkable not only for the fact that it was obtained from an extremely arid locality, but also because it is the only adult of *G. panamintinus* obtained to date having a perfect tail; *i.e.*, non-regenerated (plate 1, upper figure). This specimen was sent alive to Dr. Robert C. Stebbins, Museum of Vertebrate Zoology, University of California, Berkeley, and was thriving on a specially enriched meal-worm diet at the time of this writing.

The specimens of *G. panamintinus* obtained during the 1959-1960 field studies extend the range of this species from the type locality at Surprise Canyon, Nelson Mountains, and Daisy Canyon, Inyo Mountains (figure 1). The altitudinal distribution of the currently known specimens of *G. panamintinus* is summarized in figure 7. *Gerrhonotus panamintinus* appears to occur in certain desert mountain ranges in a narrow band, ranging in altitude from 3800 to 5100 feet, in more diverse and more arid environmental situations than previously known. External morphological variation of the specimens examined is shown on table 2. Variation in dorsal color pattern is demonstrated by plate 1.

Gerrhonotus panamintinus is morphologically close to *G. multicarinatus* and was most likely derived from it. Since many of the Great Basin valleys were inundated with water to form lakes of varying sizes during the Pleistocene (Hubbs and Miller, 1948), with the effect of a more moist climate, it is

TABLE 2. *External Morphological Variation in* Gerrhonotus Panamintinus *from Saline Valley Hydrographic Basin*

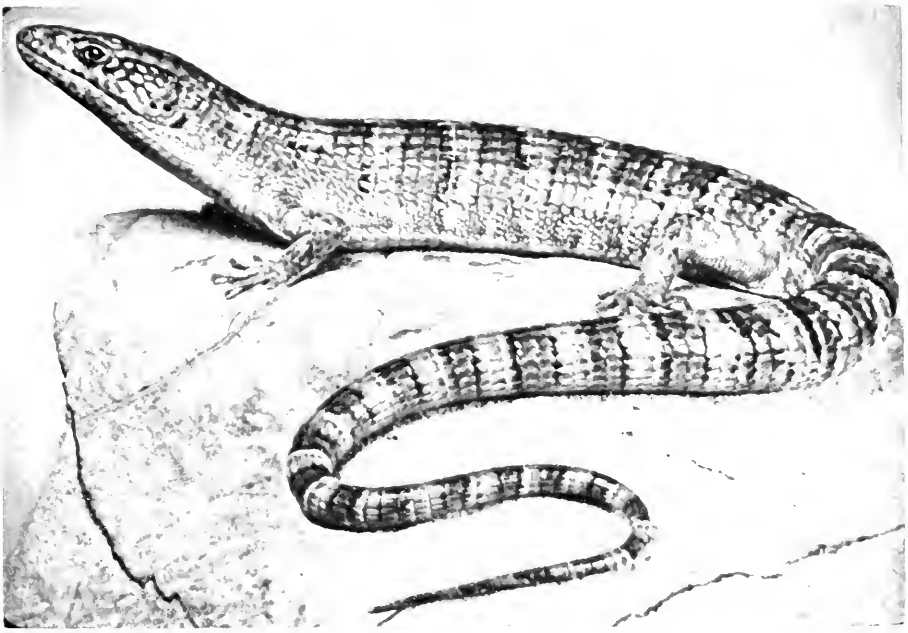
STATION NUMBER	12	13	14	16	16	125
CAS NUMBER	89677[2/]	89230	89675[2/]	88135	89676	MVZ[2/]
SEX	Female	Male	Male	Female	Male	Male
DORSAL TRANSVERSE BANDS ON TRUNK	8	8	8	8	10	8
DORSAL SCALE ROWS:						
Transverse	49	49	47	48	47	47
Longitudinal	15	14	14	14	14	16
Longitudinal Rows Keeled	11	11	12	11	11	11
VENTRAL SCALE ROWS:						
Transverse	45	45	45	44	44	45
Longitudinal	12	12	12	12	12	12
Gulars	21	20	21	20	20	20
LABIALS:						
Upper	12	11	11	11	11	11
Lower	10-12	10	10	10	10	10-11
MEASUREMENTS: (in mm.)						
Snout-vent Length	110	103.5	92	112	122	119
Tail Lenght	102 R[3/] 62	116 R 79	127 R 42	87 R 57	151 R 70.5	207
Axilla-Groin Distance	64	55	51	58	62	62
Head Width	13	14.3	12.1	15	20.1	18
Snout-Ear Distance	21.7	22.4	20.3	21.8	26	22
Foreleg	27	28.5	27.5	26	29	32
Hindleg	30	33	32	33.6	37	38

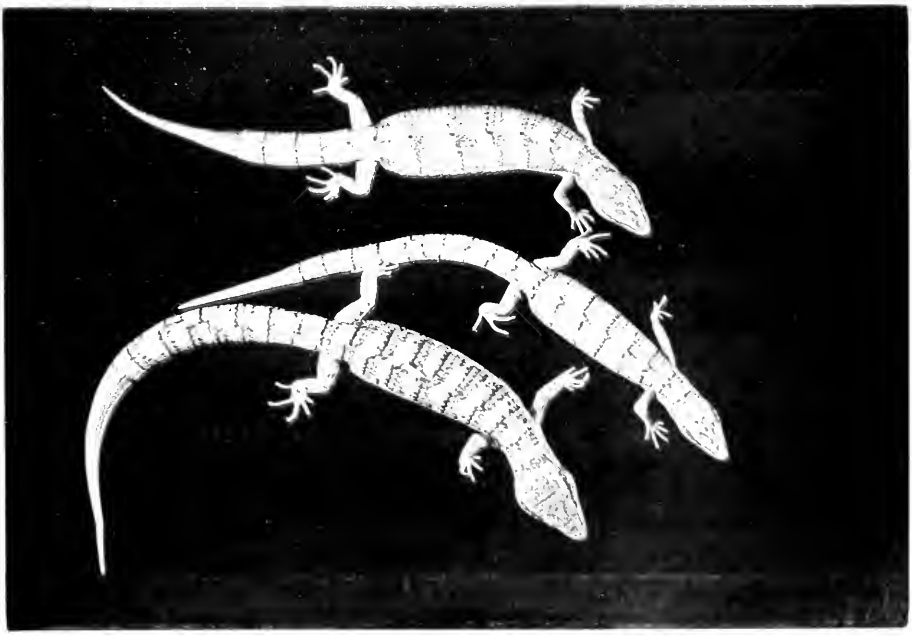
2/ Measurements taken while lizard was alive.
3/ R = regenerated portion of tail.

PLATE 1

Upper figure. Adult male collected at north side of Daisy Canyon, Inyo Mountains, Station 125. Elevation 4000 feet. June 11, 1959. This is the only specimen in which the tail was not regenerated. Photograph by Dr. Nathan Cohen.

Lower figure. Color variation within 3 living specimens from Grapevine Canyon, Nelson Mountains. June and September, 1960. Top to Bottom, CAS 89676 male [Station 16, elevation 4850 feet]; CAS 89675 male [Station 14, elevation 5000 feet]; CAS 89677 female [Station 12, elevation 5100 feet]. Photograph by Dr. W. I. Follett.





not inconceivable that a distributional connection between the populations of *G. panamintinus* in the Inyo and Panamint mountains and the other western Great Basin ranges existed with populations of *G. multicarinatus* which now occur under xeric conditions on the north slope of the San Bernardino and San Gabriel mountains.

Gerrhonotus panamintinus seems more closely related to the gerrhonotine group which includes *G. multicarinatus* of west central and southern California, *G. cedroensis* from Cedros Island, Baja California, and *G. paucicarinatus* from the Cape region of Baja California, than to *G. kingi* of southern Arizona and the adjacent Mexican mainland. This, if true, would support a hypothesis that there are three primary centers of origin for the existing reptile fauna of western North America, west of the Rocky Mountains. A significant number of the nominal species within the Colorado drainage of Arizona were probably derived from progenitors in what is now the state of Sonora, Mexico, and the Mexican Plateau, and a number of the nominal reptile species in southern California and the western Great Basin region were derived from progenitors in peninsular Baja California, Mexico, and the Mexican Plateau.

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